1998-99 DRIVE AXLES

7 5/8", 8 1/2", 8 5/8" & 9 1/2" Ring Gears

MODEL IDENTIFICATION

Vehicle model can be identified by fifth character of Vehicle Identification Number (VIN), stamped on metal pad on top of left end of instrument panel, near windshield. See **MODEL IDENTIFICATION** table.

MODEL IDENTIFICATION

Series (1)	Model
"C"	2WD Pickup, Sierra, Silverado, Suburban, Tahoe & Yukon
"G"	Express, G-Van & Savana
"K"	4WD Pickup, Sierra, Silverado, Suburban, Tahoe & Yukon
"L"	AWD Astro & Safari
"M"	2WD Astro & Safari
"S"	2WD Blazer, Jimmy, Pickup & Sonoma
"T"	AWD Bravada, 4WD Blazer, Envoy, Jimmy, Pickup & Sonoma
(1) Fifth character of VIN.	

DESCRIPTION

NOTE: 8 1/2" ring gear differential is also used as front drive axle on K2 models. K2 models may also be equipped with a Dana front drive axle. Some models are equipped with a locking differential. For testing and overhaul procedures, see DIFFERENTIALS - EATON LOCKING article.

Drive axle assembly is hypoid gear type with integral carrier housing. This type assembly is used on light-duty emission vehicles with semi-floating axles. Differential side bearing preload adjustment and drive pinion depth adjustment are made by using shims. Pinion bearing preload is made with a collapsible spacer. A removable differential cover permits inspection and minor servicing of differential without removing axle assembly from vehicle.

AXLE RATIO & IDENTIFICATION

Rear axle identification is stamped on forward side of axle tube. The first 3 digits indicate rear axle ratio, the next digit indicates axle assembly build source code and the next 3 digits indicate the day built.

LUBRICATION

Fill differential with appropriate amount of 80W or 80W-90 GL-5 gear lubricant. See **LUBRICATION SPECIFICATIONS** table. On models with limited-slip or locking differential, add 4 ozs (.12 L) of limited slip additive.

LUBRICATION SPECIFICATIONS

Aplication	Specification
"C" & "K" Series	
8 1/2" & 8 5/8" Ring Gear	4.2 Pts. (2.0L)
9 1/2" Ring Gear	5.5 Pts. (2.6L)
"G" Series	
8 5/8" Ring Gear	5.3 Pts. (2.5L)
9 1/2" Ring Gear	5.9 Pts. (2.8L)
"L" & "M" Series	4.0 Pts. (1.9L)
"S" & "T" Series	
7 5/8" Ring Gear	3.8 Pts. (1.8L)
8 5/8" Ring Gear	4.2 Pts. (2.0L)

TROUBLE SHOOTING

See appropriate table in **TROUBLE SHOOTING** article in GENERAL INFORMATION.

REMOVAL & INSTALLATION

AXLE SHAFT & BEARING

Removal

1. Raise vehicle and support. Remove rear wheels and brake drums. Place drain pan below differential cover. Loosen, but DO NOT remove, differential cover bolts. Break cover loose. Allow lubricant to drain. Remove differential cover. Remove differential pinion shaft lock bolt.
2. On non-locking differential assemblies, remove differential pinion shaft. Push outer flanged end of axle shaft toward center of vehicle. Remove "C" lock from axle shaft groove and from counterbore recess in side gear. Remove axle shaft from axle housing.
3. On locking differential assemblies (with thrust block and clutch packs), move pinion shaft part way out. Rotate differential case to lock pinion shaft against carrier housing. See **Fig. 1** .

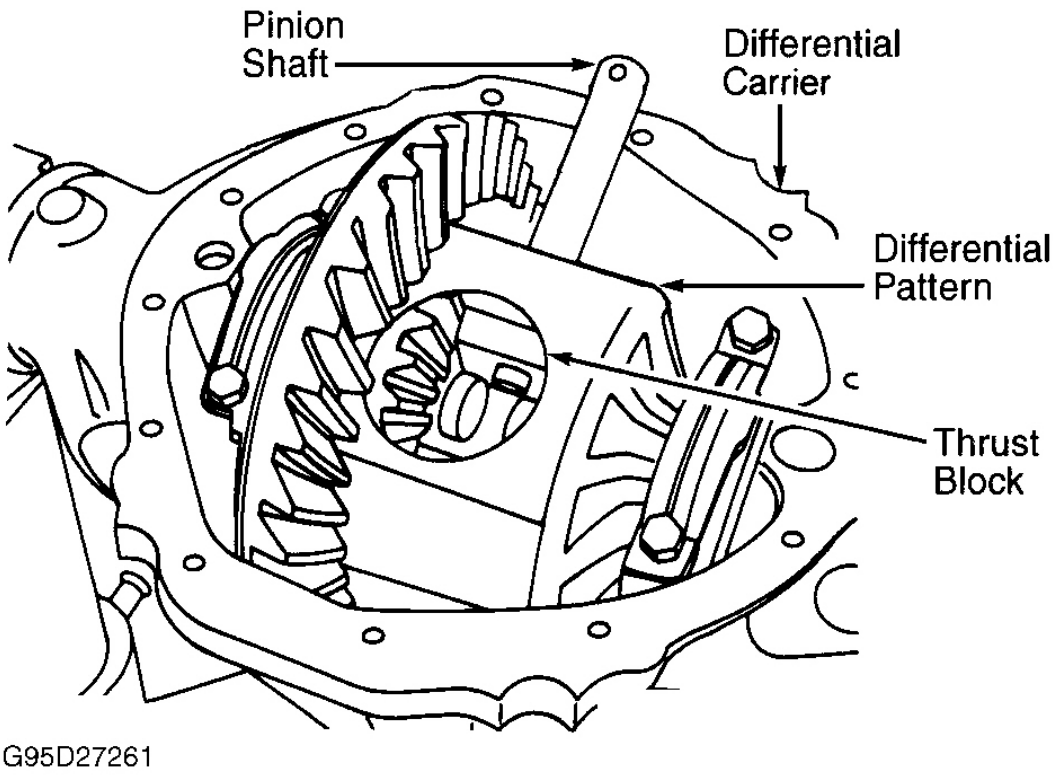

Fig. 1: Removing Axle From Locking Differential Assembly
Courtesy of GENERAL MOTORS CORP.

4. Using screwdriver, rotate "C" lock until its open end faces thrust block and "C" lock is aligned with thrust block sides. See **Fig. 2** . Push axle shaft inward. Remove "C" lock from thrust block and axle shaft groove. Remove axle shaft from axle housing. See **Fig. 2** .

CAUTION: DO NOT hammer on axle shaft flange.

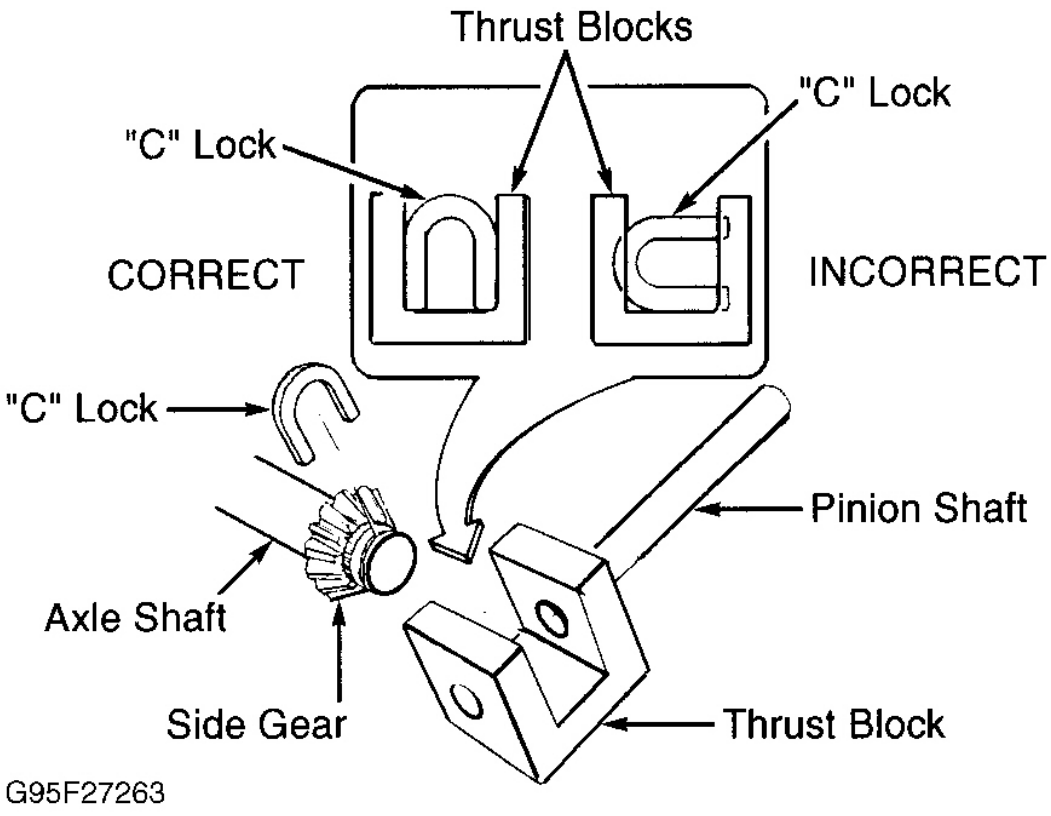

Fig. 2: Removing "C" Lock From Locking Differential
Courtesy of GENERAL MOTORS CORP.

5. On all assemblies, insert Axle Bearing & Seal Remover into axle housing behind bearing. Attach Slide Hammer (J-2619) and Adapter (J-2619-10) to bearing remover. Remove axle bearing and axle seal. See **Fig. 3** .

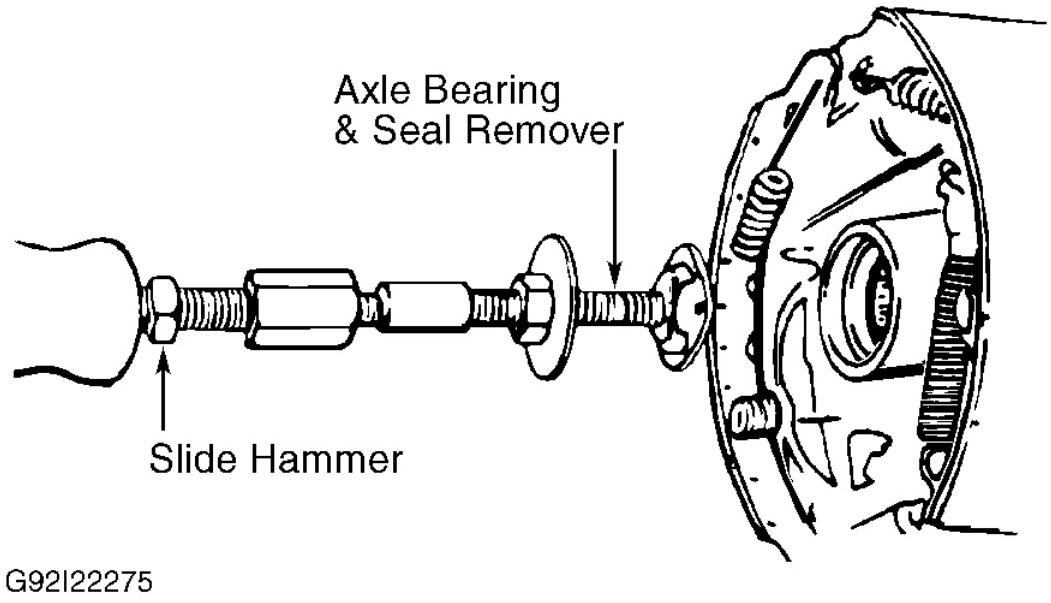

Fig. 3: Removing Axle Bearing & Seal
Courtesy of GENERAL MOTORS CORP.

Installation

1. Lubricate axle shaft cavity using gear oil. Using Bearing Installer (J-8092), install axle shaft bearing into housing until bearing installer bottoms against housing shoulder.
2. Using Seal Installer (J-21128) for 8 1/2 and 8 5/8 or (J-29713) for 9 1/2, install axle shaft seal into housing until seal bottoms against housing shoulder. Install axle shaft and "C" lock. Ensure not to damage seal. On non-locking differential assemblies, install "C" lock on bottom of axle shaft. On locking differential assemblies, install "C" lock so that ends are flush with thrust block. See **Fig. 2** . On all assemblies, pull axle shaft outward to seat "C" lock.
3. Coat pinion shaft lock bolt threads with Loctite 242. Install pinion shaft and pinion shaft lock bolt. Tighten lock bolt to specification. See **TORQUE SPECIFICATIONS** table. To complete installation, reverse removal procedure. Reseal differential cover using gasket or RTV sealant. Tighten differential cover bolts in a crisscross pattern to specification. Fill differential with lubricant.

PINION FLANGE & OIL SEAL

NOTE: If replacing pinion and ring gear, discard original pinion flange after removal. Replacement pinion, ring gear and pinion flange are balanced as an assembly.

Removal

1. Raise and support vehicle. Remove rear wheels and brake drums. Mark drive shaft, axle shafts, pinion

flanges and output shafts for reassembly. Unbolt drive shaft, and wire aside. Using tape, secure "U" joint bearing caps. Using an INCH-lb. torque wrench, rotate pinion several revolutions. Stop and start rotation several times. Note and record pinion bearing preload.

2. Match mark pinion-to-nut and nut-to-pinion flange for reassembly purposes. Count and record number of exposed threads on pinion.
3. Hold pinion flange with Pinion Flange Holder (J-8614-01). See **Fig. 4** . Remove nut and washer. Install Pinion Flange Remover (J-8614-1, J-8614-2 or J-8614-3) through pinion flange holder. Pry pinion seal from housing.

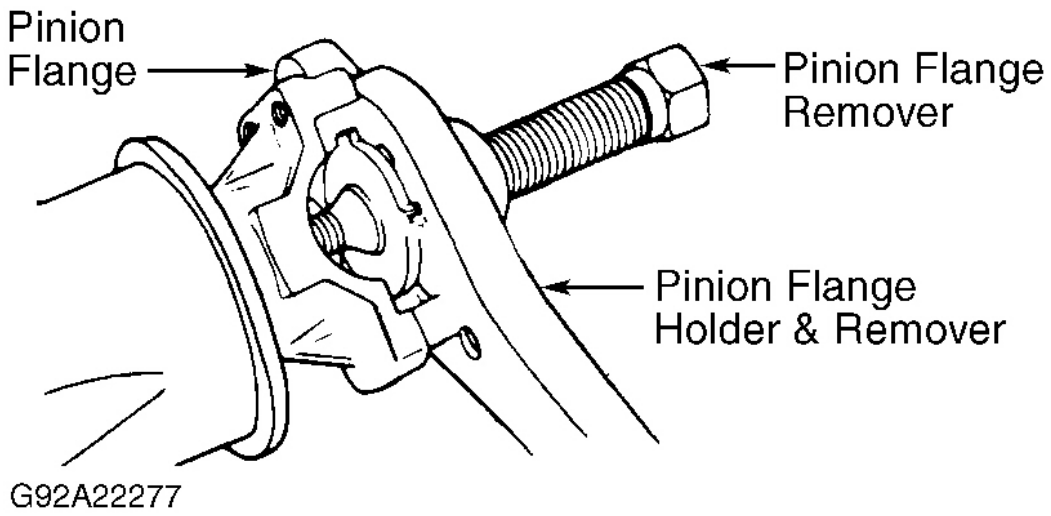

Fig. 4: Removing Pinion Flange
Courtesy of GENERAL MOTORS CORP.

Installation

1. Thoroughly clean contact area. Inspect pinion flange oil seal surface and drive splines. Replace pinion flange if damaged. Lubricate inside diameter of seal. Place pinion seal in housing bore.
2. Using Seal Installer (J-23911 for 7 5/8", J-22836 for 8 1/2" and 8 5/8", or J-22388 for 9 1/2"), install pinion seal. Apply a coat of high-temperature lubricant to pinion seal lip.

CAUTION: DO NOT hammer flange onto pinion shaft to install. Ring gear and pinion will be damaged.

3. Align pinion flange marks with marks on pinion. Install pinion flange. Install washer and NEW nut to pinion. Tighten nut snug, taking note of scribe marks and number of exposed threads. Measure pinion preload. Using pinion flange holder and remover, tighten nut in small increments. Rotate flange after each increment. Tighten pinion nut until original preload.

4. On all models, except "S" and "T" series trucks, if original preload was less than 3 INCH lbs. (.3 N.m), set preload to 3-5 INCH lbs. (.3-.6 N.m). On "S" and "T" series trucks, set preload to 3-5 INCH lbs. (.3-.6 N.m) greater than original recorded specification. On all models, if rotating torque has been exceeded, a new collapsible spacer will have to be installed. Install drive shaft. Add lubricant as needed.

REAR HUB & CARRIER ASSEMBLY

Removal & Installation

1. Raise vehicle. Allow rear hub and carrier assembly to hang free. Drain lubricant. Remove rear wheels and brake drums. Remove parking brake cable. Disconnect drive shaft and brake lines. Disconnect vent hose from assembly. Support assembly. Disconnect height sensor, ABS sensor and brake proportional valve linkage (if equipped).
2. Disconnect shock absorbers at assembly. Remove stabilizer shaft (if equipped). Remove "U" bolt nuts, washers, spacers and spring plates. Lower and remove assembly from vehicle.
3. To install assembly, reverse removal procedure. Bleed brake system. Adjust height sensing and brake proportional valve linkage (if equipped).

OVERHAUL

DIFFERENTIAL ASSEMBLY

Disassembly

NOTE: Check and record ring gear backlash and pinion bearing preload before disassembly.

1. Remove axle shafts. See **AXLE SHAFT & BEARING** under REMOVAL & INSTALLATION. Roll out differential pinions and thrust washers. Mark pinions and thrust washers (left and right). Remove side gears and thrust washers. Mark side gears and thrust washers (left and right).

CAUTION: Differential case side bearings are preloaded. Differential case will fall free after being pried past a certain point.

2. Mark differential case side bearing caps and housing. Loosen bearing cap bolts. Remove caps, mark shims, spacers, and side bearing races. Using pry bar, pry against housing at window of differential case and remove case.
3. Place any loose shims with appropriate left and right bearing races. Using Differential Side Bearing Puller/Remover (J-22888) and Adapter (J-8107-2 for 7 5/8", J-8107-4 for 8 1/2" and 8 5/8", or J-8107-3 for 9 1/2"), remove differential case side bearings. DO NOT pull on bearing cage, pull on bearing cone.
4. Ring gear bolts have left-hand threads. Remove ring gear bolts. Tap ring gear off carrier using a soft drift and hammer. Using an INCH-lb. torque wrench and proper socket, check torque required to rotate drive pinion. If no preload reading is obtained, check for looseness of pinion assembly, bearings or weak collapsible sleeve.

CAUTION: DO NOT damage pinion bearings when removing pinion from differential housing.

5. Remove pinion flange. See **PINION FLANGE & OIL SEAL** under REMOVAL & INSTALLATION. Install pinion nut back onto pinion. Install rear differential cover using 2 bolts to keep pinion from falling out. Tap end of pinion (using soft drift and hammer) to remove pinion from front bearing.
6. Remove differential cover and pinion assembly. Remove pinion oil seal and front bearing from housing. Remove collapsible spacer from pinion. Remove inner bearing from pinion using a press and Bearing Remover Clamp (J-25320 for 7 5/8", J-8612-B for 8 1/2" and 8 5/8", or J-22912-01 for 9 1/2"). Press bearing from pinion, and remove shim.
7. Remove pinion bearing races from axle housing using hammer and punch. Inspect bearings and bearing races. Replace as required. Discard and replace pinion oil seal, pinion nut and collapsible spacer.

Cleaning & Inspection

Clean all parts. Inspect all small gears, thrust washers, bearings and races for chipping, cracks or wear. Inspect axle shaft splines, ring gear and pinion teeth. Inspect pinion shaft for cracks or excessive wear. Inspect pinion flange oil seal surface, drive splines, flange ears and bearing contact surface. Replace components as required.

Reassembly

1. If installing new ring gear and pinion, and/or pinion bearings, see **DRIVE PINION DEPTH** and **SIDE BEARING PRELOAD** under ADJUSTMENTS. After installing original pinion shims onto pinion, install inner pinion bearing onto pinion using Bearing Installer (J-5590). Drive bearing onto pinion until bearing is tightly seated against pinion shims.
2. Install a NEW collapsible spacer onto pinion. Lubricate pinion bearings. Install pinion into axle housing. Install outer bearing onto pinion using Bearing Installer (J-5590). Hold pinion in position from inside housing while driving bearing onto pinion. To install pinion oil seal and pinion flange, see **PINION FLANGE & OIL SEAL** under REMOVAL & INSTALLATION.
3. Install ring gear squarely onto differential case. Tighten ring gear bolts evenly and alternately to specification. Ring gear bolts are left-hand thread. See **TORQUE SPECIFICATIONS** table.
4. Lubricate pinion gears and side gears with gear oil. Install left and right gears and thrust washers into case as marked in disassembly. Install one pinion gear onto side gears and rotate gears until pinion gear is exactly opposite. Place second pinion gear onto side gears so that pinion gear holes are exactly opposite each other.
5. Verify pinion shaft fits through both pinion gears for alignment purposes. Install pinion gear thrust washers. Hold pinion gears in position and carefully remove pinion shaft. Rotate side gears to position pinion gears in alignment with differential case holes. Install pinion shaft and pinion shaft lock bolt. Temporarily snug tighten lock bolt.
6. If side bearings were removed, install side bearings to differential case using Press or Bearing Installer (J-25299). Using Bearing Installer (J-25299), first install Adapter (J-8107-2) to opposite bearing end of differential case to protect case surface. Drive bearing onto case using hammer, Bearing Installer (J-25299) and Adapter (J-8092). Repeat for opposite side.
7. Lubricate side bearings and install races. Install differential case into carrier housing. Install spacer between each bearing race and housing with chamfered edge of spacer against housing. Install right

bearing cap and loosely tighten bolts so that differential case is free to move but will not fall out of housing. To complete installation, see **SIDE BEARING PRELOAD** under ADJUSTMENTS.

ADJUSTMENTS

DRIVE PINION DEPTH

1. Drive pinion rear bearing shim thickness must be determined whenever a new axle housing, ring gear and pinion, or pinion bearings is installed. Shim pack thickness is determined by using Pinion Setting Gauge Set (J-21777). See **Fig. 5** .
2. Install pinion bearing races into housing (if previously removed). Install lubricated rear pinion bearing through rear of housing. Position Gauging Plate (J-23597-11 for 7 5/8", J-21777-29 for 8 1/2" and 8 5/8", or J-21777-85 for 9 1/2") to rear pinion bearing. Install stud bolt and washer through gauging plate and rear pinion bearing, pointing stud bolt toward front pinion bearing position. See **Fig. 5** .

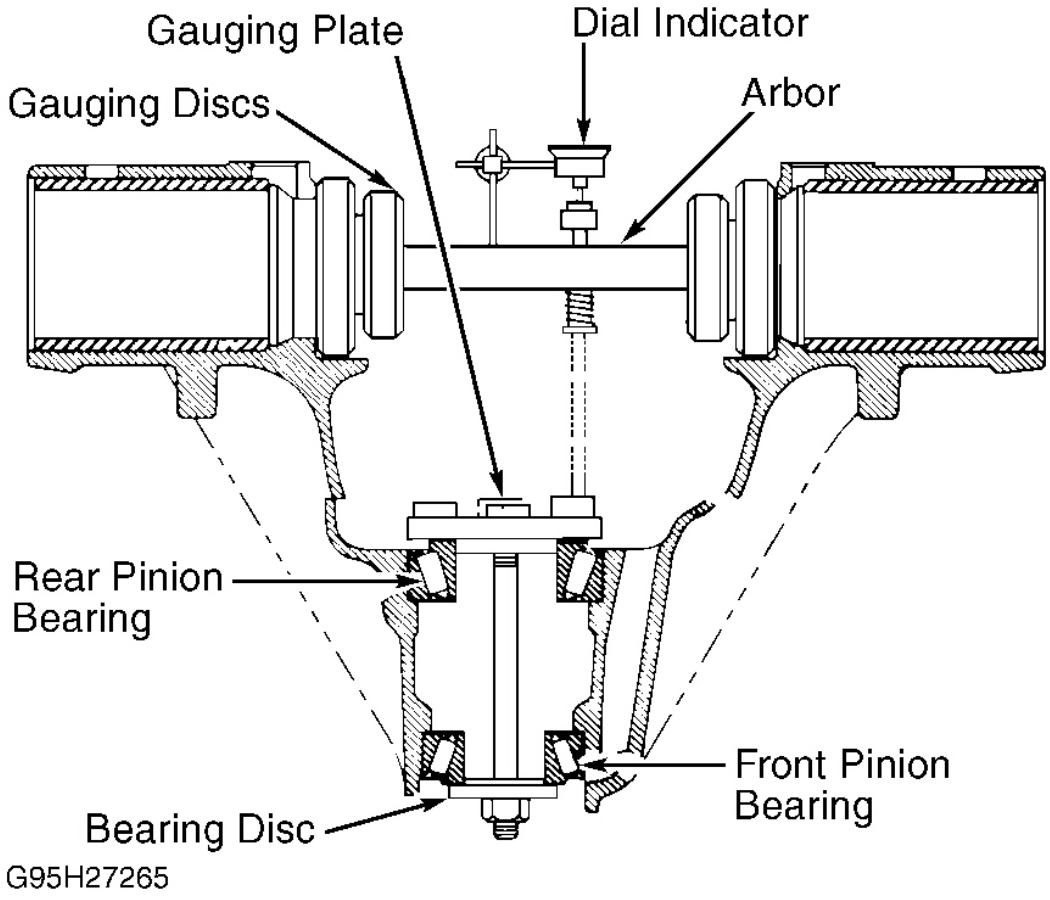

Fig. 5: Cross-Sectional View Of Pinion Setting Gauge Set
Courtesy of GENERAL MOTORS CORP.

3. Install lubricated front pinion bearing into race. Install Bearing Disc (J-21777-42) to outside of front pinion bearing. Install and tighten stud bolt hex nut until snug. Rotate gauge plate and bearings to ensure proper seating, while snugging hex nut. Hold stud bolt head stationary with a wrench. Using INCH-lb. torque wrench, tighten hex nut in small increments until 20 INCH lbs. (2.2 N.m) of torque is required to rotate gauge plate and bearings. See **Fig. 5** .
4. Mount side bearing Gauging Discs (J-21777-45 for 7 5/8", 8 1/2" and 8 5/8", or J-21777-86 for 9 1/2") on ends of arbor. Place arbor into carrier side bearing recesses making sure gauging discs are properly seated. Install side bearing caps and bolts. Snug tighten bolts to avoid arbor movement.
5. Position dial indicator on mounting post of arbor with contact button resting on top surface of plunger. Set dial indicator to zero. Push indicator down on indicator shaft until needle rotates 3/4 of a revolution to right, and then tighten in this position.
6. Place plunger onto gauging area of pinion gauge plate. Rock plunger rod slowly back and forth across gauging area until dial indicator reads greatest deflection.
7. At point of greatest deflection, set indicator to zero. Repeat rocking action several times to verify setting. Once zero reading is obtained, rotate gauge shaft to remove plunger from gauging area.
8. Dial indicator will now read required pinion shim thickness for nominal pinion setting. Record this reading. Check drive pinion for painted or stamped markings on pinion stems, or for a stamped code number on small end of pinion gear.

NOTE: If no markings are found on pinion, use dial indicator reading as shim thickness.

9. If marking is a plus (+), add that many thousandths of an inch to recorded indicator reading. If marking is a minus (-), subtract that many thousandths of an inch from indicator reading. This measurement will then be required thickness of rear pinion bearing shim pack.
10. Remove bearing caps and all gauging tools from housing. Place selected shim pack on pinion gear. Using a press, install lubricated pinion bearing onto pinion shaft.
11. Install a NEW collapsible spacer over pinion gear shaft. Install pinion assembly into position from rear of housing. While holding pinion in position, carefully drive front pinion bearing onto pinion gear shaft until a few threads are exposed.
12. Install pinion seal, pinion flange, washer and nut. Ensure pinion flange alignment mark is properly aligned with pinion shaft end mark. Using Companion Flange Holder/Remover (J-8614-01), tighten pinion self-locking nut until all end play is removed. Rotate pinion several times to seat bearings. Check preload using an INCH-lb. torque wrench.
13. Continue tightening nut and checking preload until specified preload is obtained. See **AXLE ASSEMBLY SPECIFICATIONS** table. DO NOT back off nut to lessen preload.
14. If preload is exceeded, install a NEW collapsible spacer and retighten self-locking nut until proper preload is obtained.

SIDE BEARING PRELOAD

NOTE: Adjust drive pinion depth prior to performing side bearing preload adjustment.

7 5/8", 8 1/2" & 8 5/8" Ring Gears

1. Side bearing preload and backlash adjustment are adjusted by varying thickness of both left and right side bearing shims. Side bearings must be previously installed to differential case. Lubricate side bearings and install races.
2. Place differential case assembly into position in housing. Position ring gear tightly against pinion so backlash is .000-.001" (0-.025 mm). Hold assembly in place by hand temporarily. Install Bearing Strap (J-22799-6) to left side bearing race.
3. Install Side Bearing Backlash Gauge (J-22779) between left side bearing race and carrier housing. See **Fig. 6** . While moving gauge up and down, tighten gauge adjusting nut until a slight drag is felt. Tighten lock bolt on side of gauge, and leave gauge in position.

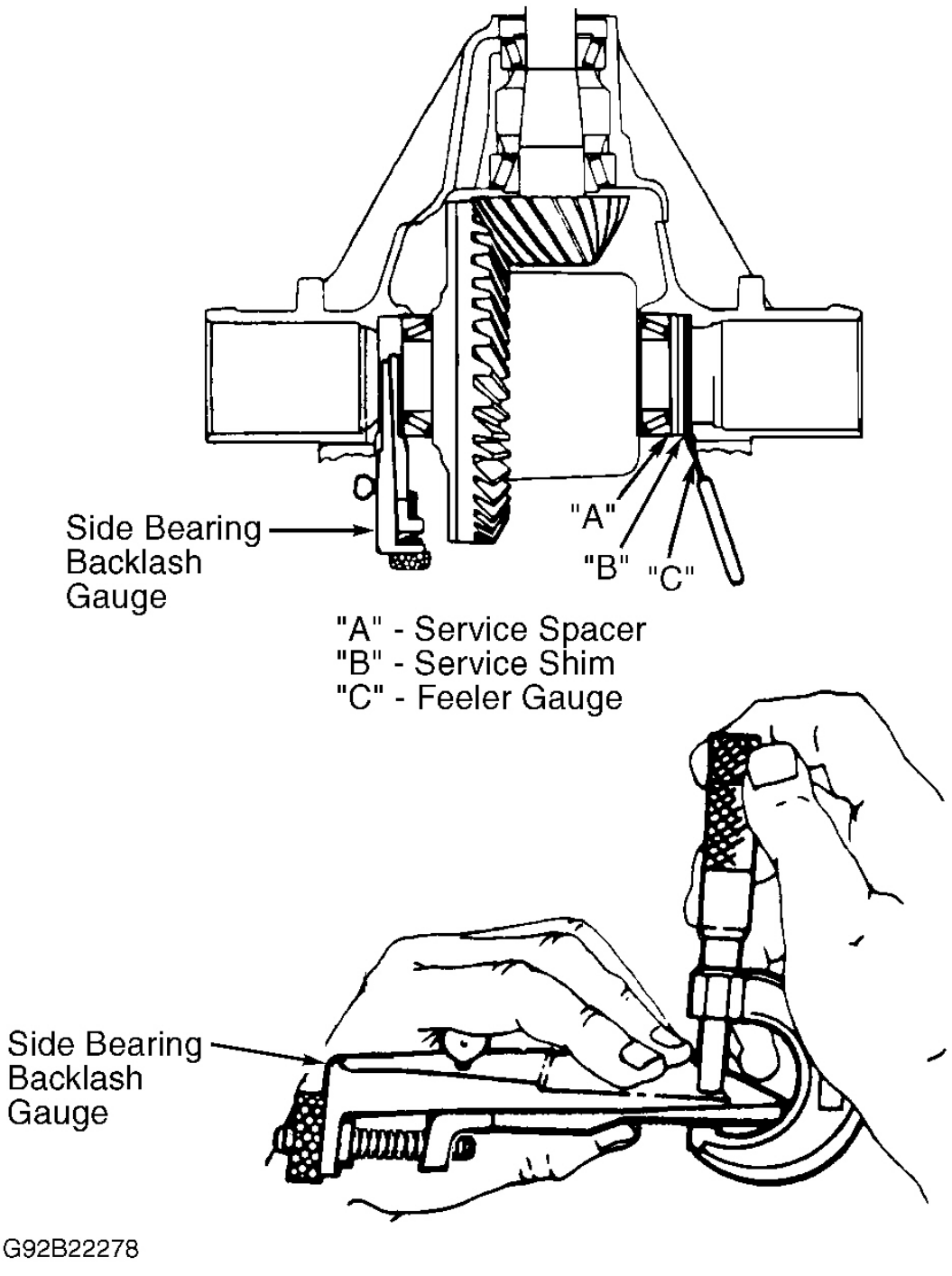

Fig. 6: Installing Side Bearing Backlash Gauge (J-22779)
Courtesy of GENERAL MOTORS CORP.

4. Install service adjustment spacer and shim between right bearing race and carrier housing. Determine

bearing preload by inserting feeler gauges between carrier and shim. The point just before feeler gauge drag begins is the correct feeler gauge thickness. This is the zero setting without preload.

5. Remove gauge from left side. Using a micrometer, measure gauge in 3 places and average readings. Record measurements.
6. Add together measurements of right side shim, spacer and feeler gauge. Subtract .010" (.25 mm) from ring gear (left) side measurement and add .010" (.25 mm) to opposite (right) side measurement. This allows for initial backlash adjustment.
7. To obtain correct preload, add .004" (.10 mm) to both measurements. Total measurement is correct shim pack thickness for each side. See following example:

Ring Gear Side (Left) Shim Pack

.250" (Gauging Tool Measurement)
-.010" (Backlash Adjustment)
+.004" (Bearing Preload)
=.244" (Ring Gear Side Shim Pack)

Opposite Ring Gear Side (Right) Shim Pack

.265" (Combined Measurement Total)
+.010" (Backlash Adjustment)
+.004" (Bearing Preload)
=.279" (Opposite Ring Gear Side Shim Pack)

NOTE: If shim is not chamfered enough and scrapes spacer when it is installed, file or grind chamfer before installation.

8. Install ring gear side shim first, and wedge opposite side shim between bearing cup and spacer. Install shim so chamfered side is against spacer. If necessary, partially remove differential case to install right side shim. If necessary, carefully tap shim into place with a soft-face hammer. Tighten bearing cap bolts to specification. See **TORQUE SPECIFICATIONS** table. Check backlash. See **BACKLASH & FINAL ASSEMBLY** .

9 1/2" Ring Gear

1. Differential side bearing preload is adjusted by adjusting nut in right differential bearing bore and by adjusting shims in left bearing bore. Bore and bearing cap provide mating threads for preload adjusting nut.
2. Install bearing races to differential bearings. Install differential case into axle housing assembly and temporarily hold in position by hand. Install bearing shims so chamfered side is against spacer.
3. Push differential case away from pinion and install adjusting nut. Tighten right side preload adjusting nut using Spanner Wrench (J-24429). Turn pinion to seat differential case bearings.
4. Back off adjusting nut slightly. Install bearing caps and snug tighten bolts. Turn adjusting nut until nut contacts shim. Note nut position and tighten nut 3 additional slots.

5. Tighten bearing cap bolts to specification. Install adjusting nut lock bolt and tighten to specification. See **TORQUE SPECIFICATIONS** table. Check backlash adjustment. See **BACKLASH & FINAL ASSEMBLY** .

BACKLASH & FINAL ASSEMBLY

1. Rotate pinion and differential case several times to seat bearings. Using a dial indicator mounted to axle housing, check ring gear backlash at 4 different teeth locations around ring gear. Install indicator in line with gear rotation and perpendicular to tooth angle.
2. Ensure pinion flange is locked in position or held rigid while taking each backlash reading. Four backlash readings should not vary more than .002" (.05 mm).

NOTE: DO NOT change total shim pack thickness for each side bearing. If a shim is removed from one side, add same thickness shim to other side.

3. Total backlash reading should be .005-.009" (.13-.23 mm). If backlash is incorrect, adjust side bearing shims as necessary. After backlash adjustment is completed, perform gear tooth contact pattern check. See **GEAR TOOTH CONTACT PATTERNS** article in GENERAL INFORMATION.
4. If pattern is incorrect, adjust pinion or ring gear as required. Install axle shafts, "C" locks, pinion shaft and lock bolt. Install rear housing cover and add gear oil. See **Fig. 7** .

AXLE ASSEMBLY SPECIFICATIONS

AXLE ASSEMBLY SPECIFICATIONS

Application	In. (mm)
Ring Gear Backlash	.005-.009 (.13-.23)
Side Bearing Preload	
7 5/8", 8 1/2" & 8 5/8"	.008 (.20)
9 1/2"	Zero plus 3 Slots
	INCH Lbs. (N.m)
Pinion Bearing Preload (1)	
7 5/8" Ring Gear	
New Bearings	24-32 (2.7-3.6)
Used Bearings	8-12 (1.0-1.4)
8 1/2", 8 5/8" & 9 1/2" Ring Gear	
New Bearings	20-25 (2.3-2.8)
Used Bearings	10-15 (1.1-1.7)
(1) Preload measurement is torque needed to turn pinion in housing without differential case and ring gear installed.	

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Differential Bearing Adjusting Nut Lock Bolt	25 (34)
Differential Cover Bolts	20 (27)
Drive Shaft-To-Pinion Flange Bolts	
Except C3500 Heavy Duty & "S" & "T" Series	15 (20)
C3500 Heavy Duty	27 (36)
"S" & "T" Series	
2.2L	15 (20)
4.3L	33 (45)
Pinion Shaft Lock Bolt	27 (36)
Ring Gear-To-Differential Case Bolt (1)	
7 5/8" Ring Gear	90 (120)
8 1/2" & 8 5/8" Ring Gear	90 (120)
9 1/2" Ring Gear	105 (145)
Side Bearing Cap Bolt	
8 1/2" & 8 5/8" Ring Gear	60 (81)
9 1/2" Ring Gear	60 (81)
Side Bearing Preload Adjusting Nut Lock Bolt	
9 1/2" Ring Gear	22 (30)
Spring "U" Bolts ("S" & "T" Series)	
Inner Nuts	41 (56)
Outer Nuts	48 (65)
(1) Left-hand thread. Use NEW bolts.	

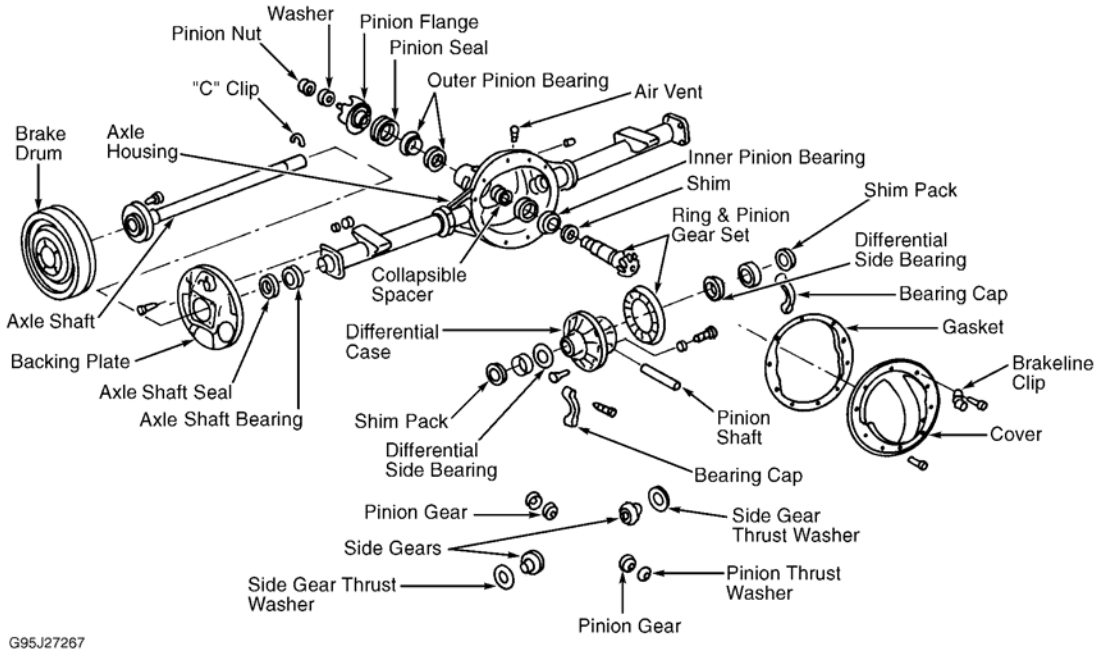

Fig. 7: Axle Assembly (8 1/2" & 8 5/8" Shown; Others Similar)
Courtesy of GENERAL MOTORS CORP.